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United States Department of the Interior
National Park Service

National Register of Historic Places Multiple Property Documentation Form

This form is used for documenting property groups relating to one or several historic contexts. See instructions in National Register Bulletin *How to Complete the Multiple Property Documentation Form* (formerly 16B). Complete each item by entering the requested information. For additional space, use continuation sheets (Form 10-900-a). Use a typewriter, word processor, or computer to complete all items

X New Submission _____ Amended Submission

A. Name of Multiple Property Listing

Reinforced Concrete Bridges of Montana, 1900-1961

B. Associated Historic Contexts

The Early Years of Reinforced Concrete Bridge Construction in Montana, 1900-1915

The Montana Highway Department and Reinforced Concrete Bridges, 1916-1961

C. Form Prepared by

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D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR 60 and the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation.
(_____ See continuation sheet for additional comments.)

Signature and title of certifying official | Date

State or Federal Agency or Tribal government

I hereby certify that this multiple property documentation form has been approved by the National Register as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper Date of Action

Table of Contents for Written Narrative

Provide the following information on continuation sheets. Cite the letter and title before each section of the narrative. Assign page numbers according to the instructions for continuation sheets in National Register Bulletin *How to Complete the Multiple Property Documentation Form* (formerly 16B). Fill in page numbers for each section in the space below.

E. STATEMENT OF HISTORIC CONTEXTS

Introduction

Army civil engineer John Mullan built the first bridges in northwestern Montana in 1860. The primitive log structures crossed the St. Regis-DeBorgia River and nearly all of them washed out during the spring run-off in 1861. Mullan diligently replaced the bridges and built a six-span structure across the Blackfoot River near present Missoula during the winter of 1862-63. The Blackfoot River Bridge was an important component of the Mullan Military Road until 1868 when it washed out and was temporarily replaced by a ferry. After gold was discovered in southwestern Montana in July 1862, the resulting stampede brought hundreds of newcomers to what had before been a sparsely settled area. Additional gold strikes in 1863 and 1864 triggered bigger stampedes to the region. By 1865, newly-established Montana Territory boasted a population of around 28,000 people. Transportation was critical to Montana, so, in December 1864, the first territorial legislature licensed nearly two dozen companies to build toll roads and bridges. None of the bridges, however, were designed by an engineer and they often failed or were in such poor condition that users frequently complained to the legislature about them. By 1872, user complaints and high tolls compelled the legislature to abolish the toll road system in Montana. The counties assumed control of the territory's roads and bridges and taxed their residents to maintain them. By the early 1880s, Montana was criss-crossed by a network of roads and timber bridges that were, for the most part, in deplorable condition. The remoteness of the territory, the nascent agricultural industry, and the decline of mining made the improvement of the system impractical until the territory could be connected to the rest of the country by a better and more reliable means of transportation – the railroads.[1]

The completion of the Utah and Northern Railroad in 1881, the Northern Pacific Railway in 1883, and the St. Paul, Minneapolis and Manitoba Railroad (Manitoba) in 1887 significantly changed the way Montanans did business and how its residents got around the territory. Instead of by road or steamboat as it had been previously, by the late 1880s all of the commercial freight moved through the state over one of those lines. The railroads caused Montana's road system to function more as farm-to-market routes that provided access to the railroads than as an inter and intra-state system. The counties expended little money on roads and bridges during that period. Eventually, however, good bridges would be critical to the economic prosperity of the territory. The railroads significantly changed Montana's transportation landscape and caused a profound change in the system by allowing the cheap importation of steel and other materials necessary for an evolving road network. The railroads caused a boom in vehicular steel bridge construction in the territory. The first all-steel vehicular bridge, the Missouri River Bridge at Fort Benton (24CH335; listed 1980) was built in 1888 and still stands. It had a substantial impact on the economy of Fort Benton, a former river port that transitioned into a major agricultural trade community because of the bridge and the community's location on the Manitoba Railroad.[2]

The Fort Benton Bridge marked the beginning of a new era of bridge construction in Montana, one that was based on modern engineering principals and the use of structural steel and concrete rather than wood. Steel became the material of choice for bridges and the Northern Pacific and Great Northern railroads could easily haul it to Montana from fabrication plants in the East and Midwest. Along with prominent steel truss structures across major river crossings, Montana counties also utilized simple timber, steel stringer and reinforced concrete bridges on important farm-to-market roads. The immigration of people to Montana after the completion of the railroads put pressure on the county governments to provide a modern infrastructure for their constituencies. The railroads provided access to Montana for Midwest-based bridge construction companies, who could economically ship steel bridge components to the state at prices the counties could afford. Although active in the state before

[1] Jon Axline, *Conveniences Sorely Needed: Montana's Historic Highway Bridges, 1860-1956*, (Helena: Montana Historical Society, 2005), 12-13, 1, 20; Michael P. Malone, Richard B. Roeder, and William L. Lang, *Montana: A History of Two Centuries*, Rev. ed., (Seattle: University of Washington, 1991), 68; Patricia M. Ingram, *Historic Transportation Routes Through Southwestern Montana*, (Boulder CO: Western Interstate Commission for Higher Education, 1976), 57-61.

[2] Fredric L. Quivik, *Historic Bridges of Montana*, (Washington DC: National Park Service, 1982), 24, 27.

1900, the bridge construction companies did not work with concrete until well into the twentieth century. Most of the early work with concrete was by the counties utilizing county work forces rather than by contracted bridge companies. Many of the bridges built by the counties still survive and are representative of practical bridge technology at the turn of the century. The components needed for concrete bridges, wood for forms, reinforcing steel, cement, and aggregate material, were easily moved to the construction site, structurally reliable, functional, and economical – four factors critical to their acceptance by Montana's county commissioners.[3]

The counties all followed basically the same pattern when considering the construction of concrete bridges as they did for steel truss bridges before the Montana State Highway Commission regulated the process in 1915. As county populations grew because of the expansion of the agricultural industry after 1900, county commissioners spent a great deal of time during their monthly meetings fielding requests or petitions from residents for new roads and bridges. If the commissioners determined that the petition had validity (usually by the number of people who signed it), they sent their representatives to look over the proposed route or bridge site and make a recommendation to the commissioners as to whether it would have some benefit to the people in the area or to the county. If the reviewers recommended for approval, the commissioners accepted the road as a county facility or agreed to fund the construction of new bridges.[4]

The counties maintained funds specifically for bridge maintenance and new construction. They obtained the money from annual road taxes levied against the property owners. If the county's funds included enough money, then the bridge would be paid directly out of that source. Oftentimes, however, and especially in the Yellowstone, Clark Fork, and Milk River valleys, the size of the proposed bridge often cost more money than was available in the Bridge Funds. Also, the counties sometimes planned multiple bridge projects that required greater cash outlays than available in the budgets. In those instances, the county commissioners called for bond elections to raise money for the projects. Most county bond elections for new bridges passed, demonstrating the need for the structures and the willingness of citizens to pay for them. Once the commissioners determined that a bridge could be built and had the money to pay for it, they directed the County Surveyor to ascertain the type of bridge needed as well as length and width. The County Surveyor sometimes chose an appropriate design from catalogs provided by the companies or referred to engineering manuals in the case of concrete bridges. For the most part, the county surveyor provided the designs and county forces or local contractors built concrete bridges in Montana before 1915.[5]

The Early Years of Reinforced Concrete Bridge Construction in Montana, 1900 – 1915

While steel was the building material of choice for Montana's county commissioners for river crossings in the early years of the twentieth century, they also began to look for alternate materials that could efficiently be used for short-span bridges. European and American engineers developed reinforced concrete for bridge construction in the 1870s and continuously made improvements to the material until the turn-of-the-twentieth century when its use became more widespread in the United States. Instead of the limiting steel triangles of the truss bridges, concrete allowed engineers a greater latitude of design that fit with the Progressive reform movement's tenets of efficiency and aesthetics. In Montana, Carbon County and the Montana State Penitentiary pioneered the use of reinforced concrete for bridge construction in the early twentieth century. Most Montana counties, however, had neither the inclination to use the more labor-intensive material or the necessary aggregate gravel sources to create the concrete.

In Montana, reinforced concrete for bridges didn't catch on until about 1911. Prior to that, the materials, sometimes without the reinforcing steel, were utilized for steel bridge abutments and piers. Good sources of

[3] Fredric L. Quivik, "Montana's Minneapolis Bridge Builders," *IA: The Journal of the Society for Industrial Archeology*, 10 (1984), 39, 42; George R. Metlen, *Report of the Montana State Highway Commission for the Years 1915-1916*, (Helena: State Highway Commission, 1916), 4-5.

[4] Axline, *Conveniences Sorely Needed*, 142 n2.

[5] Axline, *Ibid*.

aggregate for the cement is limited in the state as were men skilled in building the wood forms and pouring concrete. Consequently, the material was used for bridges in only two places in the state prior to the formation of the Montana Highway Commission in 1913: Carbon County and the state prison in Deer Lodge.

Carbon County

Carbon County pioneered the use of reinforced concrete for bridges in Montana beginning in 1911. Although there were good gravel sources along the Clark's Fork of the Yellowstone River and Rock Creek, the primary impetus for concrete bridges in the county was the Gibson Concrete Works in Fromberg. A Norwegian emigrant, John Gibson arrived in the Fromberg area in 1899 and worked as a carpenter in the area until purchasing a homestead that included old river bluffs rich in limestone ideal for the manufacturing of cement. Gibson began mining the limestone in 1909, formed a company to sell it, and first advertised his business in the *Fromberg Herald* in early January 1910. By December of that year, Gibson boasted that he manufactured "all kinds of cement building, foundation, and chimney blocks" as well as ornamental cornices, columns, building tiles, fence posts, and sidewalk blocks. Within a few months, the *Herald* touted the company as "one of the busiest places in Fromberg." The expansion of Gibson's company coincided with the completion of the Chicago, Burlington & Quincy Railroad's line between Billings and Franny, Wyoming in February 1911, which provided Gibson access to markets throughout the northern Great Plains, Rocky Mountains, and Midwest.[6]

Concurrent with the establishment of the Gibson Concrete Works, Carbon County embarked on a program to improve its infrastructure through the improvement of roads and the construction of bridges. Most of the bridges built by the county crossed irrigation ditches and narrow streams; it still utilized steel truss bridges at river crossings. Between 1911 and 1931, over half of the 129 bridges built by the county were reinforced concrete structures. John Gibson constructed the first of 23 reinforced concrete bridges in the county in 1913. Among those was the first reinforced concrete T-beam bridge in Montana, the Bluewater Creek (24CB1309) near Fromberg. By 1931 when he built his last bridge, Gibson was the most prolific bridge-builder in the county. Although Gibson did not build all the concrete bridges in Carbon County, he did provide all the cement used in their construction.[7]

The crowning achievement of Carbon County's concrete bridge program was the Clark's Fork River bridge at Fromberg (24CB1223; now demolished), the first multi-span concrete arch bridge built in the state. Built in 1914, the Fromberg Bridge was 219 feet long and included decorative raised pilasters on the sidewalls that gave the impression of a much more substantial bridge. It replaced an earlier timber through truss that had become dangerous and condemned by the county. Although the Fromberg Bridge was a substantial multi-arch structure, the other 46 concrete bridges built by the county during that period were simple slab and T-beam structures. With the exception of the Fromberg Bridge, most were simple one or two-span structures that were poured in place and consisted, essentially, of a single unit without discernable structural components. Single-span structures generally had extended curbs or low guardwalls flanking the deck; they did not include any decorative details. Two-span bridges usually included slightly recessed panels on the deep exterior concrete guardwalls. A visual examination of the Carbon County concrete bridges also indicates that the cement used in the concrete likely came from the same source, the Gibson Concrete Works. Both slab and T-beam type bridges built in Carbon

[6] Advertisements, *Fromberg (Mont.) Herald*, 19 January, 8 December 1910; *Directory of Billings, Red Lodge and Yellowstone and Carbon Counties*, (Billings: R. L. Polk and Co., 1909); editorial, *Fromberg Herald*, 23 March 1909; US Census Records, 1900-1930, Montana Historical Society, Helena, Montana.

[7] Advertisements, *Fromberg (Mont.) Herald*, 19 January, 8 December 1910; *Directory of Billings, Red Lodge and Yellowstone and Carbon Counties*, (Billings: R. L. Polk and Co., 1909); editorial, *Fromberg Herald*, 23 March 1909; US Census Records, 1900-1930, Montana Historical Society, Helena, Montana.

County provided the basis for both the Montana State Penitentiary and Montana Highway Department's concrete bridge programs that followed.[8]

French engineer Francois Hennebique developed a method of reinforced concrete slab construction in 1879 and patented the design in the United States in 1892. About that time, German-born American engineer Fritz von Emperger pioneered a different type of reinforced concrete slab construction that was based on Austrian engineer Joseph Melan's use of heavy steel I-beams for reinforcing. Because the Melan/von Emperger system relied heavily on I-beams to reinforce the concrete, it made the material unwieldy and expensive to use. The nature of the slab made the spanning of distances greater than 20-feet impractical because of the weight of the structure. In 1909, American engineer Claude Turner revolutionized concrete slab construction with the addition of columns to support the slab. Within a few years, however, designers discarded the column as engineering and building materials improved, namely in the introduction of steel rods for reinforcing the concrete. Prior to 1900, reinforcing steel consisted of heavy I-beams, steel cables, and wire mesh. The instruction of bendable steel bars revolutionized reinforced concrete slab, and later, T-beam, construction in the United States. In some areas of the country, like Carbon County where aggregate was plentiful, concrete slab bridges displaced the more rudimentary timber bridges by the 1930s.[9]

In the early twentieth century, concrete slab bridges were relatively simple structures to build, but were limited in the length of the spans that could be used. In Carbon County, the commissioners built slab bridges at irrigation ditch crossings where only one span was needed. For wider creek crossings, the county relied on reinforced concrete T-beam structures. First developed in the mid-1870s by American engineer Thaddeus Hyatt, the design derives its name from the "T"-shaped configuration of the support beam. The head of the "T" is incorporated into the deck slab of the structure which also functions as the floor of the bridge. While the reinforced steel reinforcement bars were fabricated as a separate unit, the "T" beams, deck slabs, and guardwalls were cast as a single section at the construction site. Concrete T-beam bridges were also more suitable to areas of heavy traffic and where environmental conditions required an alternative to steel or timber structures. The bridges, however, required skilled labor (carpenters and concrete mixers) for their construction. Carbon County built both types of concrete structures from 1911 to 1919, including 48 slab and seven T-beam bridges. The county, however, was not the only entity using the material at that time.[10]

The Montana State Penitentiary in Deer Lodge also experimented with reinforced concrete in the early part of the century. Despite opposition from labor unions who argued that prison convicts took good-paying jobs away from them, the penitentiary maintained an active road and bridge-building program for over two decades. Between 1911 and 1914, convicts constructed at least four reinforced concrete bridges near Deer Lodge. One, the Morel Bridge (24DL411; listed 2000) is the only one of its kind in the state. A through, or rainbow arch structure, the Morel Bridge was one of the first built under a patent obtained by James Barney Marsh in 1914. The type is

[8] Carbon County Commissioners' proceedings, Book C, p. 274 (n.d.), Clerk and Recorders Office, Carbon County Courthouse, Red Lodge, Montana; "New Concrete Bridge," *Fromberg Herald*, 14 May 1914; "Concrete Bridge Contract is Let," *Red Lodge (Mont.) Picket*, 14 May 1914.

[9] Milo S. Ketchum, *The Design of Highway Bridges of Steel, Timber, and Concrete*, Second ed., (New York: McGraw-Hill, 1920), 345; Carl W. Condit, *American Building: Materials and Techniques from the Beginning of the Colonial Settlements to the Present*, (Chicago: University of Chicago Press, 1968), 175; Federal Highway Administration, *America's Highways, 1776-1976: A History of the Federal-Aid Program*, (Washington DC: Government Printing Office, 1976), 432; Plowden, *Bridges*, 320.

[10] The concrete formwork was usually the most expensive portion of the construction process, absorbing anywhere from 10 to 60% of the total construction cost of the bridge. Jeffrey A. Hess and Robert M. Frame III, *Historic Highway Bridges in Wisconsin: Stone and Concrete-Arch Bridges*, Volume 1, (Madison: Wisconsin Department of Transportation, 199); Federal Highway Administration, *Bridge Inspection Training Manual*, (Washington DC: US Department of Transportation, 1979), G-4; Condit, *American Building*, 169; Plowden, *Bridges*, 247-248.

characterized by arches flanking the deck rather than located underneath it. The streamlined appearance of the bridge kept with the Progressive principle of efficiency and the belief that concrete added new dimensions to engineering design. The construction of the concrete forms for this type of bridge required skilled labor. Prison records indicate that in 1914 two civil engineers, twelve carpenters, and two cement workers were incarcerated in the penitentiary. There is no record, however, if any of these men were on the work crews constructing the bridges.[11]

Built by convict labor in 1911, the Conley Street Bridge (24PW608) crosses the Clark Fork at the south end of the old prison grounds in Deer Lodge. It provided access between the penitentiary and the Milwaukee Road and Northern Pacific railroad yards. Warden Frank Conley told the State Board of Prison Commissioners that a "new cement bridge will cost in the neighborhood of $1600.00 provided it is built with convict labor which will take twenty convicts three days." The bridge was an experiment in the use of T-beams, a style that became increasingly popular as World War I neared because it allowed for longer reinforced concrete bridges that were better able to support heavier loads than more simple concrete slab structures. Instead of recessing the beams underneath the deck as was done on the Bluewater Creek bridge in Carbon County, the outside beams were placed flush with the structure's sidewalls on the Conley Street bridge.[12]

Prison convicts built at least four reinforced concrete bridges in the aggregate-rich Clark Fork valley in western Montana. But in eastern Montana, concrete bridges were not practicable outside the river bottoms on the high plains. The broken, semi-arid landscape that had once been the home of the buffalo was broken by dry coulees, intermittent stream beds, and few rivers. They were not wide enough to warrant the construction of expensive steel truss bridges and there were not the resources necessary for concrete structures. Consequently, the counties built hundreds of simple steel stringer bridges – steel I-beams laid across the creek or coulee and resting on earthen abutments braced by wood backwalls.[13]

The Montana Highway Department and Reinforced Concrete Bridges, 1916-1958

The Highway Department Steps In: The Early State Use of Reinforced Concrete, 1916-1928

The Thirteenth Legislature's creation of the State Highway Commission in March 1913 caused a profound change in Montana's bridge industry. The commission was the result of many years' lobbying by state good roads groups to develop engineering standards for roads and impose order on the bridge-building industry. Importantly, the Congress's impending passage of the first Federal Aid Road Act in 1914 made it mandatory that the states establish state highway commissions to manage the federal funds. When formed in March 1913, the highway commission consisted of three civil engineers who were appointed to the position by the governor. At first, the commission was only an advisory body that provided information on modern road construction techniques to the state's counties. It published pamphlets, developed a statewide highway map, and met with local governments about their transportation needs. Even with the state's increased influence on road and bridges matters, the counties still followed the old system of advertising and letting contracts for new bridges because there was no state money available to them for construction.[14]

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[11] Frank Conley, *Nineteenth Annual Report for the Montana State Prison for the Year Ending December 31, 1914*, (Deer Lodge: Montana State Prison, 1915), 17, 27; "Morel Bridge (24DL411)," National Register of Historic Places registration form, Montana State Historic Preservation Office, Helena.

[12] Conley, *Nineteenth Annual Report*, 17.

[13] Axline, *Conveniences Sorely Needed*, 54-55.

[14] In Montana, the good roads groups included community commercial clubs and chambers of commerce, road organizations such as the Yellowstone Trail Association and the Montana Good Roads organization, and "persons interested in good roads." In 1913, these groups and individuals came together at the request of the newly-formed Montana State Highway Commission and formed a Citizens Advisory Board to assist the commission in its decision-making about road and bridge improvements in the state. Information about the month-to-month operations of the State Highway Commission are contained

In June 1913, the highway commission organized a conference in Helena that included the state's county surveyors and a few county commissioners to outline the priorities the commission should follow in developing its road and bridge programs. The highway commissioners divided the attendees into five advisory committees, each assigned to develop recommendations for specific problems related to road construction, surveying, mapping, convict labor, and bridges. The bridge committee's recommendations addressed the main problem then plaguing the counties: their dependence on the bridge construction companies.[15]

The committee recommended that all bridge company plans be submitted to the State Highway Commission for approval before the counties let the contracts. The commission would check the plans, bids, and building materials to ensure the counties got their money's worth when purchasing a new bridge. The committee, however, recommended against the highway commission developing standardized bridge plans to allow counties the option of choosing the most suitable and affordable design. The committee also recommended the highway commission investigate the use of reinforced concrete for bridges rather than the more expensive steel. Despite the committee's recommendation, the commission's initial interest in concrete was only for culverts.[16]

Not until a 1915 legislative directive ordered the highway commission to adopt most of the committee's recommendations, thus requiring the commission to address the issue of bridges. The legislature ordered it to provide standard plans and specifications for all bridges that cost more than $500. Typically, bridges that cost less than that amount were built by county forces and did not require a contractor or the time-consuming advertising/bidding process. More expensive bridges, however, entailed the advertising for bids and the development of a detailed plan. Instead of allowing bridge companies to submit as many designs as they saw fit in order to win a particular contract, now they could only submit one design. The legislative mandate suggests that the counties recognized the problem dishonest contractors, and their "utter lack of any technical knowledge" about bridge engineering.[17]

The 1915 state legislature also expanded of the State Highway Commission to accommodate its added responsibilities to the counties for standardized bridge designs, the review of bid packages, and contract oversight. The expansion coincided with an economic boom in Montana. In 1909, the federal government passed the Enlarged Homestead Act to promote the agricultural development of the Great Plains. The opportunity for free land and economic self-sufficiency in the American West proved irresistible to people throughout the United States. Between 1910 and 1918, nearly 400,000 would-be farmers and their families moved to the Treasure State. At the same time, mineral production in Butte and the surrounding area also flourished. Demand for building materials, generated by the booming economy and staggering population growth proved to be a boon to the state's timber industry. The immediate pre-World War I years were, indeed, a good time to be in Montana.[18]

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in a series of minute Meeting Books. The original Books are housed at the Montana Department of Transportation in Helena with microfiche copies available at the Montana Historical Society. Montana Highway Commission Meeting Minutes, Book 1, 67 (2 April 1915); *Laws, Resolutions and Memorials of the State of Montana Passed by the Thirteenth Regular Session of the Legislative Assembly*, (Helena: State Publishing, 1913), 318-326; M. J. Steere, *History of the Montana State Highway Department, 1913-1942*, (Helena: State Highway Commission, 1943), 9-12.

[15] Montana Highway Commission Meeting Minutes, Book 1, 13-15 (17 June 1913).

[16] Quivik, *Historic Bridges*, 43; Montana State Highway Commission Meeting Minutes, Book 1, 13-15 (17 June 1913).

[17] *Laws, Resolutions and Memorials of the State of Montana Passed by the 14th Regular Session of the Legislative Assembly*, (Helena: State Publishing, 1915), 332-333; Metlen, *Report of the Montana State Highway Commission*, 4-5.

[18] Michael P. Malone, Richard B. Roeder, and William L. Lang, *Montana: History of Two Centuries*, Rev. Ed., (Seattle: University of Washington, 1991), 242.

In March 1915, the highway commission formed a bridge department and hired Utah engineer Charles A. Kyle to head it up because of his extensive experience in the design and construction of steel bridges. Over the next month, the commissioners and Kyle hammered out the details of Montana's new bridge-building system, which included guidelines for letting contracts and distribution of standardized bid sheets to all the counties. Although these bridge plans were housed at the county courthouses, the commission required contractors to obtain final plans from the bridge department in Helena to ensure that the contractors built the bridge to the specifications defined in the standard plans. The counties remained responsible for letting the contracts and paying for the structure. The state, however, supervised the construction and inspected the bridges before authorizing payments to the contractors. Most Montana counties welcomed the involvement of the state bridge department in their bridge projects.[19]

By the end of its first year, the commission's bridge department had worked through the procedural details of its new system and regularly provided plans to the counties for steel truss and a few concrete bridges. The commission promoted Kyle to Chief Bridge Engineer and authorized him to hire "competent engineers to supervise the construction of new steel bridges" in the state. Indeed, by the end of 1915, Kyle and his assistants had overseen the counties' construction of nearly seventy steel and three concrete bridges in the state. Kyle also developed standard plans for timber and steel stringer bridges. The state legislature reorganized the highway commission in 1917 to better manage the additional responsibilities caused by Montana's $1.5 million share of the first Federal Aid Highway Act. The policies and procedures enacted by the commission in regard to the bridge department remained in effect. The restructured highway commission was more concerned with road-building than bridges – with the exception of two Great Falls bridges on Second Avenue North and Tenth Street.[20]

Reinforced concrete allowed more variations in design than did the rigid steel truss bridges built at that time. Although the basic guts of the design for slab and T-beam bridges had been codified many years before, there were many ways an engineer could design around those elements that made the bridges more aesthetically pleasing and yet functional. Engineer Kyle standardized a basic slab and T-beam designs for Montana by 1916. The designs appear to be based on those developed by the American Concrete Institute earlier in the decade. In Montana, it included girders recessed under the deck (on T-beam bridges), decorative concrete guardwalls pierced by rectangular openings (sometimes, however, the openings were in-filled), flared endposts, corniced balustrades on the guardwalls, and solid concrete piers and abutments. The highway commission built the first bridges of this design on the Butte-Anaconda section of the Yellowstone Trail (later US Highway 10), and on the road between Lewistown and Hilger in Fergus County. One bridge included in this MPD represents this early Montana State Highway Commission design: the Mud Creek Bridge (24LA207).[21]

The Second Avenue North and Tenth Street (24CA308; listed 1996) bridges represented a significant change in the commission's procedures. Although it was capable of designing small one or two span reinforced concrete bridges, it did not have the expertise to design the reinforced concrete bridges of the scale required to cross the wide Missouri River in Great Falls. Because both structures would be located at important entrances to the city, Cascade County and the City of Great Falls wanted showpiece bridges that would enhance the gateways to the

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[19] Metlen, *Report of the Montana State Highway Commission*, 5-8; Montana Highway Commission Meeting Minutes Book 1, 71, 72 (14 May 1915; 18 May, 1915).

[20] Montana Highway Commission Meeting Minutes, Book 1, 93 (12 July 1916); "Bridge Building in Montana," *Dillon Examiner*, 24 November 1915; "Many New Steel Bridges," *Dillon Examiner*, 15 December 1915; Metlen, *Report of the Montana State Highway Commission*, 8-10; Montana Highway Commission Meeting Minutes Book 1, 81 (5 November 1915).

[21] Metlen, *Report of the Montana State Highway Commission*, 6; Jon Axline, *Monuments Above the Water: Montana's Historic Highway Bridges*, (Helena: Montana Department of Transportation, 1993), 60.

city from the north and west. In 1919 the highway commission and Cascade County hired Great Falls architect George Shanley to design two truly spectacular bridges, with open spandrel arches, turned baluster posts, and exposed structural features. Built by the Porter Brothers Company of Spokane, both structures provided models for the Carter Bridge (24PA777) in Park County and the St. Mary's Bridge in Glacier County. Despite the aesthetic appeal of the reinforced concrete bridges at Great Falls, the commission continued to focus on steel as its material of choice. There were few engineers in the commission's bridge department skilled in the use of reinforced concrete, which forced it to hire architects and other specialists to design and build them.[22]

The 1920s marked a transitional period in the construction of bridges in Montana. Changes in the organization and funding of the Federal Aid highway system by Congress in 1922 and 1926 had a profound effect on Montana, the State Highway Commission, and the counties. Most notably, was the formation of the Montana Highway Department in 1919. Prior to then, all activities occurred under the aegis of the highway commission and it was known collectively as the State Highway Commission. With the creation of the department, however, the highway commission became responsible for the political agenda of road and bridge building as well as awarding contracts, managing the department's budget, setting policies, and working with the federal Bureau of Public Roads (BPR). The highway department was responsible for the actual design, construction, and maintenance work on Montana highways. The department operated under the direction of the Chief Engineer, who supervised other department heads, including the bridge department. The Chief Engineer was responsible for ensuring that the highway department carried out the program set by the highway commissioners. The commission's and highway department's relationship with the BPR also became more formalized in the Twenties. The BPR channeled federal funds to the state, approved all projects scheduled by the department, and had the final approval of plans developed by the state's bridge department. The BPR was also responsible for the design and construction of roads and bridges on federally-owned land, such as the national forests, and national parks. The process of road and bridge building in Montana became much more bureaucratically structured in the 1920s as the federal government channeled more money into the state for that purpose.[23]

The Federal Aid Act of 1921 and its 1922 amendment more doubled the federal allocation for road and bridge construction in Montana. Although the commission used most of the money for road improvements, a substantial amount found its way into the highway department's bridge budget. Prior to 1926, the counties were responsible for the construction of roads and bridges within their jurisdictions. Increasingly during the 1920s, however, the state gradually gained control of highway and bridge construction in Montana by reducing the amount of matching funds needed by the counties. The counties were nominally the lead in the process, but it was the highway commission that controlled the purse strings. In 1926, the commission assumed control of the entire preconstruction and construction process – including payment for the project with federal and state funds. The counties still provided partial funding of bridges, but the commission through the highway department managed the contracts with the builders and decided where the bridges would be located.

The revived bridge program included the construction of one of the commission's showcase projects during the Twenties. The project involved the use of newly standardized multi-arch reinforced concrete bridge design based on the Tenth Street Bridge in Great Falls and developed by the highway department's engineers. They developed a design that would accommodate modern traffic and provide an aesthetically pleasing bridge on the approach to Yellowstone National Park in the Paradise Valley south of Livingston. Carter Bridge (24PA777) is located at the site of one of the earliest river crossings in Park County. The county replaced the first bridge, a log toll bridge built by Tom Carter in the early 1880s, with a 220-foot combination timber and steel span in 1898. High winds destroyed the bridge in 1908, and the county replaced it with a new timber and steel span built by the Montana Bridge and Iron Company of Livingston. High water damaged the bridge in 1918. The site's bad luck

[22] Montana Highway Commission Meeting Minutes, Book 1, 124-125 (12 April 1917); Cascade County Commissioners Journal, Book 8, 530; Montana Highway Commission Meeting Minutes, Book 1, 163 (1 February 1918).

[23] Steere, *Montana State Highway Department*, 19-21, 23.

with timber and steel bridges compelled Park County and the highway commission to look at alternatives for a new bridge there. In January 1919, the bridge department and the BPR adapted George Shanley's Tenth Street Bridge design for use at the Carter bridge crossing. In August 1919, the county and state highway commission awarded the project for the new bridge to the B. M. Crenshaw Company of Livingston.[24]

Problems plagued the project. Shortly after Crenshaw began work on the bridge, it became obvious to the highway department's engineers and the First State Bank of Livingston, the company's bond holder, that the company was not quite up to the task of building the complicated structure. Design changes, inexperienced workers, and the lack of clear direction from the highway department caused Crenshaw to suspend work on the bridge for several weeks until the problems could be resolved. Crenshaw's shoddy work on the guardrails caused concern with highway department's chief engineer John Edy. He complained that the bridge's appearance was "very good at a slight distance, but rough when viewed from a short distance." He blamed the poor visual appearance on Crenshaw's inability to construct the proper concrete forms, which allowed the concrete to ooze out between the cracks. He criticized Crenshaw's work on the guardrails, noting that they appeared sufficiently "unworkmanlike as to inevitably draw public attention to its defects." In his haste to complete the project, Crenshaw had ignored the Commission's design specifications. In retaliation, the commission, at the recommendation of the highway department engineers, declined to accept the bridge and Crenshaw refused to make the necessary changes. Eventually, Creshaw's bond holder, the First State Bank, hired workers to complete the work on the Carter Bridge. Despite the problems Crenshaw encountered during the construction of the Carter Bridge, the company continued to obtain contracts from the highway commission until 1935 and built two other reinforced concrete bridges.[25]

The highway department built one more open-spandrel reinforced concrete arch structure in 1926. Constructed by Angus McGuire and Evarts Blakeslee of Great Falls over the St. Mary River near Babb, it utilized the same design as the Carter Bridge. Blakeslee had been the highway department's project engineer on the Tenth Street Bridge project in Great Falls five years earlier. By the late 1940s, however, the St. Mary River Bridge was badly deteriorated and in dire need of replacement. After the completion of the St. Mary Bridge, the highway department abandoned the large reinforced concrete arch bridge design. Prohibitive labor costs of the bridges and their limited use at wide shallow river crossings made them unappealing. As importantly, evidence suggests that design problems with the intricate open spandrel arches made the structures difficult for contractors to build the bridges to the strict standards of the department's engineers. There were also chronic problems with the buckling of the bridges' concrete decks and the durability of the baluster posts.[26]

The Montana Highway Department generally utilized arch bridges at places where they would most enhance either an urban gateway or a scenic highway. It built three small, single-span concrete arches in 1926 and 1927 on U.S. 89 north of Kiowa Junction on the Blackfeet Reservation on an important approach road to Glacier National Park (24GL236 and 24GL237). All three were veneered with rubblestone to make them blend into the spectacular landscape. They were the last arch bridges built by the highway commission.[27]

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[24] Construction File No. FAP 14: Carter Bridge. Montana Department of Highways Bridge Bureau Records, B 7: 1-7 (2004). Montana Historical Society, Helena.

[25] Quivik, *Historic Bridges*, 69; Construction File No. FAP 14: Carter Bridge. Montana Department of Highways Bridge Bureau Records, B 7: 1-7 (2004). Montana Historical Society, Helena.

[26] Ibid; *Report of State Highway Commission for Period Ending December. 1928*, (Helena: State Highway Commission, 1929), 29; As-Built Plans: St. Mary River Bridge [FAP No. 227-B], Montana Department of Transportation, Helena (4 August 1926); Construction File No. 12: Great Falls Bridges. Montana Department of Highways Bridge Bureau Records, B 7: 1-7 (2004). Montana Historical Society, Helena; Montana Highway Commission Book 10, 283-284 (18 November 1948).

[27] As-Built Plans: South Fork of Milk River and Lake Creek Bridges [FAP No. 227-A]. Montana Department of Transportation, Helena (22 July 1926); Montana Highway Commission Book 3, 23, 25 (27, 28 April 1926); *Report of State Highway Commission*, 29.

During the 1920s, the highway department concentrated on the construction of simple reinforced concrete slab and T-beam bridges. Department engineers modified Charles Kyle's standard design to include higher concrete guardwalls with semi-elliptical arched and diamond-shaped openings in the wall rather than rectangles (Bad Route Creek Bridge, 24DW425). That design was adopted by the Bureau of Public Roads and used until well into the 1930s. The design, however, may have included more decorative detailing than the steel and timber bridges, but the structures appeared bulky and massive. Despite that, the department built 22 reinforced concrete bridges from 1925, when the design change was implemented, to 1929 when it changed the design yet again. Concrete bridges comprised seven percent of the 305 total number of bridges built during that period. In 1929, the highway department completely changed the design of the bridges to make them appear more modern, which was in keeping with the department's initiation of a program to upgrade and improve the state's highways. The new Art Deco-influenced design included a thinner, overhanging deck, open piers and abutments, tapered and beveled endposts with double-coursed guardrails tilted at a 45º angle, and flared endposts with decorative bush-hammered panels or vertical grooves. The result was an open streamlined design that reflected the department's efforts to modernize the state's highways.

Regardless of the problems with the Carter and St. Mary bridges, the highway department increasingly used reinforced concrete for smaller bridges because of technological improvements in the material and the contractors' better understanding of its properties. Highway department bridge engineers also learned that the material functioned well for long-span crossings over railroad grades as long as the design was kept relatively simple. Consequently, in 1928 the highway department first used reinforced concrete for a railroad overpass or grade separation structure. At-grade railroad crossings on high traffic roadways or narrow openings through existing railroad trestles were a concern for the commission during the 1920s, but it did little to improve the situation until late in the decade. Great Falls contractors Angus McGuire and Evarts Blakeslee built the first reinforced concrete railroad overpass between Montana City and Clancy on U.S. Highway 91 (the structure was demolished in 1969 with the construction of Interstate 15). The Great Northern Railway paid half the cost of the six-span structure under protest because it argued that the structure benefited motorists more than it did the railroad. Although it lost the argument in this particular structure, the Great Northern and the Northern Pacific Railway frequently appeared before the highway commission to dispute funding overpasses. The highway department built reinforced concrete grade separations over the Milwaukee Road between Harlowton and the Idaho border at Lookout Pass because the locomotives were electrically powered and did not produce corrosive steam and, later, diesel fumes. On railroads, such as the Northern Pacific and Great Northern, with steam and diesel-powered locomotives, overpasses usually consisted of reinforced concrete approach spans with steel stringer main spans that could between resist the heat and steam.[28]

The Golden Age of Reinforced Concrete Bridge Construction in Montana, 1929-1941

The Great Depression devastated Montana. Drought and declining prices for agricultural goods, copper, timber, and oil put thousands of Montanans out of work and their families in desperate need of relief. Ironically, hard times contributed to the transformation of Montana's transportation system from one of the worst in the United States to one of the nation's best in less than a decade. President Franklin Delano Roosevelt's New Deal programs put unemployed Montanans to work on a variety of public works projects, including improvement or construction of the state's roads and bridges. The transformation, however, was not always an easy one as federal and state governments struggled to work out the details of the funding formulas, strict employment guidelines, and set priorities for the road and bridge building programs.

From 1930 to 1941, the Montana Highway Department built nearly 3,000 miles of road and 1,213 bridges, many of which still survive on the state's two lane roads. The federal government believed that one of the paths to economic recovery was highway projects. Only about 8 percent of the bridges built by the department during the 1930s were reinforced concrete bridges. Most were inexpensive timber structures designed to span the countless

[28] Montana Highway Commission Meeting Minutes, Book 4, 79 (21 June 1928), 97 (20 July 1928).

creeks and dry coulees in eastern Montana. They also met the intent of the federal government's economic relief programs: they required large numbers of laborers. While not structurally distinctive, timber bridges played a vital role in the state's economic recovery by putting hundreds of unemployed men back to work.[29]

The department built 73 reinforced concrete bridges from 1930 to 1932 under the Hoover Administration's limited economic relief programs. Concrete, however, required abundant and adjacent supplies of good aggregate material. Thus, the scarcity of both gravel and water on the high plains limited concrete bridge construction. Even when aggregate was close at hand, reinforced concrete bridges were costly to build, requiring a large skilled labor force to construct forms, install the reinforcing steel, and correctly mix the concrete. Only a few contractors had the necessary experience to build the bridges, including Evarts Blakeslee and Angus McGuire of Great Falls and Tom McGeever of Butte. Most of the concrete bridges they built were located in the Yellowstone, upper Missouri, and Clark Fork valleys where aggregate sources and water was plentiful.

For the most part, reinforced concrete bridges were comparable in length to the more abundant timber bridges, consisting of one or two spans with a maximum length of 99 feet. The cost of the wood needed for the concrete forms, the aggregate, reinforcing steel, and concrete, however, made them more expensive per foot to build than timber bridges. Timber bridges cost about $2,119 per structure, while a reinforced concrete bridge cost around $6,265 to construct – or about twice the price of a timber bridge. By the mid-1930s and New Deal years, the federal government and State Highway Commission's goal was to build more inexpensive bridges in order to put more people to work. Reinforced concrete fell out of favor with the commission except for use as approach spans to steel truss structures and railroad overpasses.[30]

Before the onset of the Great Depression, the federal law stipulated that the state match the federal funds provided to Montana. The state raised the funds primarily through taxes on gasoline sold in the state. After 1930, however, the state did not have the revenue necessary to match the federal funds. Beginning in 1930, the federal government funded Montana's bridge program through a series of emergency relief acts. The legislation, simply stated, provided Montana with its federal funding allocation without the matching money from the state. Instead, the federal government planned to withhold portions of the state's future allocations until the amount was paid off. Funding provided by the Hoover Administration, however, was quite a bit different than during Roosevelt's New Deal a few years later. In December, 1930, the Administration pushed through its first Federal Road Relief Act. It allocated $1.67 million to Montana for road and bridge projects. In early 1931, the state legislature enacted the first of several debentures to supplement the federal money.[31]

Importantly, Hoover's federal relief legislation placed restrictions on the money in order to provide the maximum amount of employment and, therefore, ease the states' unemployment problems. Specifically, Congress stipulated that the contractors hire local workers, maintain maximum thirty hour work weeks, and that only a minimal amount of machinery be used on road and bridge projects to ensure the need for manual labor in quantity. The State Highway Commissioners warned that any contractor who did not comply with the employment provisions would be disqualified from bidding on future contracts. The system worked well enough that the Roosevelt Administration continued the employment policies in its New Deal programs.[32]

Until the Interstate highway era of the 1960s and 1970s, more reinforced concrete bridges were constructed during the Great Depression than at any other time in the state's history. Between 1930 and 1941, the Montana

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[29] Steere, *History of the Montana State Highway Department*, 55.

[30] John Fenn, "Did You Know that . . . ," *Center Line*, 3, No. 7 (July 1940), 5.

[31] Malone, Roeder, and Lang, *Montana*, 296; Steere, *History of the Montana State Highway Department*, 28.

[32] Steere, *Ibid*, 28-29; Montana State Highway Commission Meeting Minutes, Book 4, pp. 413, 447 (5 January, 26 March 1931).

Highway Department built 101 reinforced concrete bridges, mostly in western and south central Montana. About 72 percent of the total number of concrete bridges built by the department occurred from 1930 to 1932 under the auspices of the Hoover Administration's emergency relief program; 35 concrete bridges were built in 1931 alone. Concrete bridges constituted about 15 percent of the 482 bridges built during that period. Most of the bridges were located on US highways 10 and 91 and most were reinforced concrete T-beam bridges. All displayed the open, streamlined Art Deco-influenced design developed by the highway department in 1929. The Sheep Creek Bridge (24LC1157) is an excellent example of the standard 1930s Highway Department design.

During FDR's New Deal years, the focus of the highway department's bridge program changed. Instead of relying on labor-intensive reinforced concrete bridges, the department began an extensive program of building simple treated timber bridges, mostly in eastern Montana. Indeed, the department built only 28 reinforced concrete bridges from 1933 to 1941 and 71 percent of those were railroad grade separation structures. The move from reinforced concrete to treated timber reflected the department's concentration on simple inexpensive bridges that could be built in large numbers by largely unskilled labor. While 28 concrete bridges were built during that eight-year span, the highway department built 623 timber bridges during that same period. Reinforced concrete, however, proved particularly suitable to railroad grade separation structures. Built under the federal government's Works Progress Grade Separation Program, twenty of the 28 concrete bridges built between 1933 and 1941 were railroad overpasses. Concrete overpasses constituted 54 percent of the total number of grade separation structures built at that time.

Within three months of his inauguration in March 1933, President Franklin Roosevelt pushed through legislation creating the National Industrial Recovery Act (NIRA). Title II of the Act created the Public Works Administration (PWA), which distributed the $400 million allocated to the states for public works projects, including roads and bridges. Montana received nearly $7.5 million from the PWA specifically for road and bridge construction. The PWA initiated the greatest boom in road and bridge construction yet seen in Montana. By the time the U.S. Supreme Court declared the NIRA unconstitutional in May 1935, the Montana Highway Department had overseen the construction of 228 bridges. The NIRA's road and bridge program was the first real federal effort to integrate a system of primary highways, secondary farm-to-market roads, and urban routes into a national transportation system.[33]

The NIRA continued many of the policies first used under Hoover's Emergency Relief Act. Primarily, NIRA specified thirty hour work weeks, minimal use of heavy equipment, strict wage scales for skilled and unskilled labor, and, importantly, the hiring of as much local labor as possible. NIRA also mandated that labor be obtained through district National Reemployment Service offices and that the contractors keep detailed records of wages paid, number of men employed, and hours worked. NIRA's intent was to put as many men to work on public works projects as possible. Oftentimes, however, the contractors misunderstood the employment regulations or just ignored them. The wages required under the Act were often lower than the wage rates previously negotiated by the labor unions, which led to protests before the highway commissioners by union representatives and an occasional strike. Despite the increased paperwork and the lower wages, contractors rarely had problems obtaining labor on road and bridge projects.[34]

In May 1935, the U.S. Supreme Court declared most provisions of the National Industrial Recovery Act of 1933 unconstitutional. Consequently, the Roosevelt Administration folded parts of the Public Works Administration into other federal agencies and created new ones, including the Works Progress Administration. Under the auspices of the WPA regulations (which were virtually the same as those of the PWA), the state highway commission authorized the construction of 28 reinforced concrete bridges between May 1935 and December 1941.[35]

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[33] Axline, *Conveniences Sorely Needed*, 96-98.

[34] "New Highway era," *Engineering News-Record*, 19 January 1934, 66-70.

[35] T. H. Watkins, *The Great Depression: America in the 1930s*, (Boston: Little, Brown and Co., 1993), 241.

As the 1930s drew to a close and war appeared unavoidable, the priorities of the state highway commissioners and the department engineers were redirected at the direction of the Bureau of Public Roads (BPR). Increasingly, discussions in commission Meetings concentrated on the integration of Montana's roads and bridges into a national military strategic highway network. The BPR and Montana highway commission discussed at length which roads in the Treasure State had the greatest value to the national defense and which roads were of secondary importance to that purpose. Primary highways, like U.S. Highways 10 and 91, best served the nation's interests in the event of a national emergency because of their connections to strategically important places in Montana and their interstate connections. Secondary roads functioned primarily as farm-to-market routes and were not as critical to the defense system. The BPR and state highway commission established three categories of strategically important defense highways in April, 1941. The First Priority highways included U.S. Highway 10 (the main east-west highway in the state that was supplanted by Interstates 90 and 94) and Highway 91, which today parallels Interstate 15. These two highways, along with U.S. 87 between the Wyoming border and Billings, provided the necessary interstate connections and linked Butte, Anaconda, Helena, Great Falls, Billings, and the strategically important chrome mines in Stillwater County to the system. Second and Third Priority roads provided connections to important railroad centers and less important manufacturing and mining centers in Montana.[36]

The strategic highway system had a profound impact on Montana's bridge program. Because of the redirection of steel and oil supplies to military industries, the Public Roads Administration (formerly the Bureau of Public Roads) and the state highway commission prioritized its construction schedule to best meet the needs of the strategic highway system. The War Department deemed projects on First Priority highways as critical to national defense and directed that limited supplies of steel be utilized on those roads first. The highway commission and PRA then prioritized projects on the secondary system based on their proximity to strategically important main roads. As a result, it took years for the contractors to complete some bridge projects because they could not get the necessary building materials. Discussions between the commissioners and the highway department's engineers involved the modifications of existing roads and bridges to carry heavy military loads and debate on whether to post guards at important highway bridges in the event the United States got involved in the war.[37]

The Japanese attack on Pearl Harbor and Hitler's declaration of war against the United States ended the bridge-building boom, which had peaked in 1936, and transformed Montana's transportation landscape. The Public Roads Administration, state highway commission, and the highway department built well over 1,200 bridges of all shapes, sizes, and types between 1930 and 1941, including 101 reinforced concrete slab and T-beam bridges. Initially during the decade, reinforced concrete appeared to have fulfilled its promise to allow a wider range in design and aesthetics. Unlike other bridge forms of the decade (e.g. steel truss, girder, and timber), reinforced concrete permitted a design that reflected the prevailing Art Deco influence of the decade. Unfortunately, while slab bridges were easy to widen, T-beam bridges were not and it has contributed to a rapid decline in the numbers of T-beam bridges over the last fifty years. As of September 2010, only 42 of the 101 reinforced concrete bridges built between 1930 and 1941 still exist.

World War II and the Post-War Building Boom, 1942-1956

From replacing deteriorated county bridges in the 1920s to expanding Montana's infrastructure during the Great Depression, the Montana Highway Department struggled to keep up with the demands placed on it by county, state, and federal agencies. World War II brought a brief respite due to material shortages and the federal government's focus on the war effort. Beginning in 1948, however, road and bridge building boomed again as the post-war economic boom, commercial trucking, recreational tourism, and the Cold War created need for improved roads and bridges. The Cold War drove much of that economic expansion as the federal government reacted to

[36] Montana State Highway Commission Meeting Minutes, Book 8, pp. 242-243, 298-299 (24 October 1940, 18 April 1941).

[37] Steere, *History of the Montana State Highway Department*, 38-39; Montana State Highway Commission Meeting Minutes, Book 8, p. 395 (8 December 1941); Planning Survey Division, *Montana Highway History, 1943-1959*, (Helena: State Highway Commission, 1960), 1-2.

its new role as the avatar of democracy in the world. The Cold War manifested itself domestically in a variety of ways, including increased defense spending for improvement of the country's transportation infrastructure, which culminated in the Federal Aid Highway Act of 1956 which created the Interstate highway system.

Within weeks of the Japanese attack on Pearl Harbor and President Franklin Roosevelt's declaration of war, the highway commissioners canceled all bridge projects scheduled for construction for the next few years, but allowed those already underway to be completed. Only those projects essential to the national defense would be certified by the War Department." Unless the highway or bridges was located on a Priority One road of the Strategic Highway Network, the Army and Navy would not authorize the expenditure of federal funds. In Montana, only projects on U.S. Highways 10 and 91 fell into that category. The military retained strict control of steel, restricting its use for projects deemed essential to the war effort. As the highway department's demanding program during the Great Depression faded, it encouraged its employees to find work in the war industries, promising them their jobs when the "national emergency" ended.[38]

Although Montana was traversed by three major east-west routes (U.S. Highways 2, 10, and 12), only US 10 connected important commercial, industrial, and population centers in the state. The highway, which was later bypassed by Interstates 90 and 94, linked rail centers and oil refineries in Billings and Laurel to the Butte mines, Anaconda smelter, and the sawmills around Missoula to the west coast. By contrast, Highways 2 and 12 passed through sparsely populated agricultural centers. The main north-south route in the state, U.S. Highway 91 provided a connection between Salt Lake City and the Canadian border that included Butte, Helena, and Great Falls. Because the War Department had determined U.S. Highways 10 and 91 critical to the national defense, the highway commission allocated more money to road and bridge projects on those routes than it did on other roads in the state from 1942 to 1956.

The Montana Highway Department concentrated most of its bridge work during the war on U.S. Highway 10 and secondary highways in Stillwater County. Chrome mines critical to the war effort were located in the Beartooth Mountains south of Columbus off Highway 10, the only known source of the ore in the United States. Industries utilized chrome for airplane frames and other war materiel. The aging bridges in the lower Stillwater River valley did not meet federal standards for loading, roadway widths, or overhead clearances. In May 1942, the highway commissioners let a contract to build a timber through truss span across the Yellowstone River at Columbus. Built of wood because of shortages in steel caused by the war effort, the new bridge replaced an aging steel truss that could not handle the demands placed on it by the increased truck traffic between the chrome mines and U.S. Highway 10. Other priority projects related to the mines included timber bridges on Secondary Highway 420 in Stillwater County between Absarokee and the Mouat and Benbow chrome mines.[39]

The War Department funded the construction of the Yellowstone and Powder river bridges because they were critical to the war effort by keeping a significant interstate highway open. But as victory against the Axis powers appeared imminent, Congress began planning for the post-war years. To that end, it passed the Federal Highway Act of 1944, which provided the foundation for the post-war highway-building boom by allocating $1.5 billion to the states for road and bridge construction. The money, however, would not become available to them until after the conclusion of the war. Importantly, the Act created the National System of Interstate and Defense Highways and put more emphasis on roads and bridges in urban areas and secondary highways. Those roads had been largely neglected by the highway commission during the 1930s. The Act also directed Montana Governor John Bonner, the highway department's former chief legal counsel, to create the Montana Highway Planning Committee (MHPC) to study the state's highway needs over the next decade. Changing highway design standards and traffic demands made most of Montana's highway system obsolete by the end of the 1940s. Narrow roads and bridges, tight curves, and poor alignments made the Montana's highways incapable of handling the anticipated

[38] Steere, *Montana Highway Department*, 103.

[39] Montana Highway Commission Meeting Minutes, Book, 8, 427, 437 (11 May 1942, 24 June 1942).

demands traffic would place on the state's road infrastructure in the post-war years. Bonner formed the committee to address the problems, the state's future transportation requirements, and how best to finance them.[40]

Composed of engineers, businessmen, and those employed in the agricultural and mineral industries, the committee published its findings in 1948. The report concluded that most of the bridges built by the highway department in the 1930s were outmoded by current traffic demands and would not be able to tolerate the loads placed on them by the modern commercial trucking industry. Prior to World War II, there little discussion about the industry in the highway commission meetings. By the late 1940s, however, bigger trucks and increased traffic caused by the post-war economy made the highway engineers take note of the damage the trucks caused Montana's roads and bridges. Although the federal government's make-work programs of the New Deal upgraded the state's road infrastructure, years of neglect during the war made much of Montana's road system in dire need of repairs and improvements. The report cited problems with bridges not built to post-war loading standards and that many of them were narrower than the roads leading to them. Both caused serious safety hazards for motorists. Even before the committee presented its findings, the highway department embarked on a statewide program to improve bridges on both primary and secondary routes, mostly through widening already existing structures.[41]

Postponed by the Montana Highway Department during the war, many of those early post-war projects also included the construction large girder and steel stringer bridges over the Beaverhead, Bitterroot, Clearwater, Musselshell, and Madison rivers. Steel girders replaced trusses as the material of choice for river crossings in the late 1940s (they would be replaced by prestressed concrete in the early 1960s). Unlike the through trusses, girders were cheaper to construct and did not have the same overhead restrictions for commercial trucks. For shorter spans, the highway department continued to rely on timber bridges to cross smaller streams and drainages in eastern Montana. An overpass in Great Falls resurrected the railroad grade separation program in 1946. Unlike the WPGCH program of the 1930s, however, the federal government required the railroads to fund only ten percent of grade separation structures if it replaced an older overpass. The government funded the entire cost of the structure if it was a new grade separation.[42]

Years of neglect and changes in vehicle weights had a serious impact on many older bridges in Montana during the early 1950s. The highway commissioners regularly received requests by communities to replace seriously deficient and, in some cases, dangerous bridges. To add to the problem, the commissioners believed that bridges on primary roads built with county funds were not always their problem. The City of Forsyth approached the commission about replacing the Yellowstone River Bridge that carried U.S. Highway 12 traffic into the north side of that community. Instead of considering the replacement of the bridge, which the commissioners declared was Rosebud County's responsibility, they contemplated limiting the maintenance of the road that led to it until the county replaced or repaired the old bridge.[43]

In the post-World War II economic boom, stand-alone reinforced concrete bridges were of secondary importance to the Montana Highway Department. In the eleven years from 1945 to 1956, the department built 311 bridges. Only ten of those were reinforced concrete bridges. The department continued to rely on timber stringer

[40] Planning Survey Division, *Montana Highway History*, 3-4, 7.

[41] *Ibid*, 9, 46; Montana State Highway Planning Survey, *Preliminary Report on Highway Needs in Montana: Montana's Highway Problems*, (Helena: State Highway Commission, 1948), 11-12, 33, 38.

[42] Montana Highway Commission Meeting Minutes, Book 9, 165 (20 March 1945); Planning Survey Division, *Montana Highway History*, 5.

[43] Montana Highway Commission Meeting Minutes, Book 10, 76 (10 December 1947); Ibid., 12, 38, 195 (31 July 1952, 19 March 1953).

structures, but steel stringer and girder bridges increasingly become the standard highway department bridge by the mid-1950s. Described as "steel and concrete" structures in the Montana State Highway Commission Meeting Minute Books, they were concrete only in the abutments, decks, and piers. The highway radically changed the design of its stand-alone reinforced concrete bridges. Gone was the Art Deco influence prevalent in the 1930s in favor of an even more streamlined design that reflected the technological improvements of concrete and steel during the war years. Instead of the deep bulky-appearing decks, the bridges had relatively thin decks; the T-beams were rounded at the ends to provide the illusion of arched structures. The engineers replaced the heavy open hammerhead type piers and bents with rather spindly-looking columnar structures that added to the feeling of weightless that the bridges provided. Finally, the Art Deco-influenced concrete guardrails were replaced with shiny baluster metal guardrails that was the standard for all highway department-designed bridges up through the beginning of the Interstate era in the 1960s. The reinforced concrete bridges of the late 1940s and 1950s in many ways reflected the space age optimism of the decades and the technological improvements caused by World War II.

President Dwight Eisenhower signed the 1956 Federal Aid Road Act into law, creating the Interstate Highway System, the greatest public works project in world history. The highway commission and highway department spent the first years of the project planning the route of the Interstates and for its actual construction. The Interstate Program caused a profound change in how the department did business and its priorities. The sheer magnitude of the program meant that the Montana engineers had to adopt new building materials, specifically prestressed concrete, which was also durable and relatively inexpensive. The material was ideally suited for streamlining bridge designs as necessitated by the program. Unfortunately, they also represented the blandness of the interstates in that there was virtually no variation in design and appearance between the structures. The highway department built its first prestressed concrete bridge on Secondary 332 in 1958. Thereafter, the department built no stand alone reinforced concrete structures, relying instead on prestressed concrete.[44]

Aesthetics had given way to speed and convenience, which in an ironic way was the intention of the very first Montana bridge builders. Bridges built during the late 1940s and 1950s were devoid of the visual appeal represented in many of the bridges of the pre-war years. They were simple, utilitarian, and functional. They could accommodate the demands placed on them by the commercial truckers, the military during the Cold War, and by tourists. They were, sadly, not much to look at, but they served their purpose. They became uninteresting extensions of the road, precursors of the regimentation of the Interstate highway era of the next decade. What the bridges lacked in individual distinction, however, they more than made up for in their practicality. Post-war Montana bridges served their purpose and intent of the federal and state governments to provide motorists with a dependable structure that could more than accommodate the traffic placed on them.

Glossary

Abutment: A concrete or wood structure used to support the ends of bridges and to transfer traffic off the deck of the bridge.

Beam: A generic term for a variety of horizontal structural components. Beams can be constructed of wood, metal, concrete, or combinations of these materials. They may be solid, flat, I-shaped, T-shaped, latticed, or boxed.

Deck: The horizontal surface that stretches from abutment to abutment of a bridge. Traffic and utility loads are placed on the deck. In modern bridges, most decks are concrete. The deck also provides stiffness for the bridge by connecting support beams and trusses.

[44] Tom Lewis, *Divided Highways: Building the Interstate Highways, Transforming American Life*, (New York: Viking, 1997), ix; Plowden, *Bridge*, 321.

Guard Rails: Metal, concrete or wood panels on the side of bridges that serve to prevent traffic from leaving the bridge mid-span.

Guard Walls: Metal, concrete, or wood walls along the sides of bridges to prevent traffic from leaving the bridge mid-span. Closed balustrade guard walls present a solid wall surface, though many have surface decoration in the form of grooves or geometric patterns.

Jersey-barriers: A type of modern closed-balustrade guard wall that is designed to deflect traffic back onto the roadway. These barriers are either permanent or can be installed in removable modules.

Monolithic Arch: A type of concrete bridge with a solid vault and solid spandrels. Also known as a Barrel Arch bridge.

Open Spandrel: A vertical column in an arch bridge used to transfer loads from the deck or floor beams to the arch's ribs. The use of open spandrel construction significantly reduces the weight of arch bridges.

Pier: A mid-span bridge support. Piers transfer bridge loads from the spans to the ground. Piers can be either solid walls or multiple columns. Piers can be constructed of a variety of materials including concrete, metal or wood.

Pier Cap: A transverse member connecting the top of pier columns or the top of a wall pier. In beam bridges it supports the stringers of the bridge.

Piling: A metal or wood pole that is driven into relatively soft sediments to provide support for bridges, either mid-span or in the abutments.

Piling cap. A transverse member connecting a linear series of pilings. In addition to providing a support for bridge stringers, the cap also compensates for any irregularities in the tops of the piling produced by the driving of the pilings.

Rib: A curved beam used in arch bridge construction.

Spandrel: The area between the deck and the ribs of an arch bridge.

Stringers: As series of parallel beams supporting the deck of a bridge. These beams run lengthwise to the bridge and are supported by abutments and / or center supports. The terms "Stringer", "Beam" and "Girder" are often used interchangeably in the literature. However, stringers usually directly support the deck while girders are often employed transversely to support or connect the stringers. Both are composed of beams (see above).

F. ASSOCIATED PROPERTY TYPES

A. Introduction: Bridges and the National Register Evaluation Criteria[45]

This documentation form examines reinforced concrete bridges constructed in Montana from 1911 to 1956. According to National Register Bulletin No. 15, "How to Apply the National Register Criteria for Evaluation," to be eligible for listing in the National Register of Historic Places, a bridge must be significant in state, local or national history, architecture, engineering or culture, and possess integrity of location, setting, design, material, workmanship, feeling, and association. In addition, the bridge must meet one or more of the four National Register Criteria:

A. be associated with events that have made a significant contribution to the broad patterns of our history; or

B. be associated with the lives of persons significant in our past;

C. embody the distinctive characteristics of a type, period, or method of construction, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. have yielded, or may be likely to yield, information important in prehistory or history.

The specific means by which a bridge may meet each of the National Register Criteria are discussed below.

National Register Criterion A: Under Criterion A, a bridge may be eligible for the National Register through its association with historic themes. Applicable areas of significance for bridges as defined in National Register Bulletin No. 16 include:

- Exploration/Settlement: Bridges, especially early bridges, may have been associated in a meaningful way with the settlement or development of a geographically definable area. Larger bridges over major rivers may have significance for their historical associations with regional settlement or development.

- Industry: The design of bridges has been closely associated with the technology and process of producing new materials. Bridges associated with the development and introduction of new materials are important.

- Politics/Government: The construction of bridges has most often been undertaken by governmental bodies – first townships, then counties, and later the state with federal regulations and financial inducements. Bridges may be significant if they represent important patterns in the methods counties awarded contracts or are associated with standardized state designs. Although the Montana State Highway Commission began providing bridges plans to the counties in 1915, it was not until 1926 that all bridge engineering work was taken over by the state. Other important bridges may be associated with federal emergency relief and New Deal programs, such as the Works Progress Administration, during the Great Depression that were intended to create labor intensive jobs.

- Transportation: Every bridge in Montana found eligible for the listing in the National Register of Historic Places is associated with the "broad pattern" of transportation. Bridges may gain additional significance under this theme if they facilitated major passage to or through a region or played an important role in the development of an effective transportation system. Large bridges, especially the costly steel through and

[45] This section of the MPD is adapted from "Historic Highway Bridges of North Dakota" (February 1997). The document was prepared for the North Dakota State Historic Preservation Office by Mark Hufstetler of Renewable Technologies, Inc. of Butte, Montana.

deck trusses, represent major investments on the part of counties to address the public's demand for adequate transportation routes.

National Register Criterion B: Under Criterion B, a bridge may be eligible for the National Register if a historically significant person's importance relates directly to the structure. Since the National Register's guidelines state that properties significant as an important example of an engineer's skill should be nominated under Criterion C, it is rare that a bridge would be found eligible under Criterion B. Because all historic bridges in Montana were constructed from standardized designs or from designs purchased from catalogues, no bridge in the state is eligible for the National Register under Criterion B.

National Register Criterion C: Under Criterion C, a bridge may be eligible for the National Register if it embodies "the distinctive characteristics or a type, period, or method of construction, or represents the work of a master, possesses high artistic value, or represents a significant and distinguishable entity whose components may lack individual distinction." The only applicable area of significance for bridges under this criterion from Bulletin 16 is in the category of engineering.

The design and popular use of bridge types has been closely tied to the development of new materials and an understanding of their use. Bridges can provide excellent illustrations of the changes that have occurred in metal and concrete technologies. Some bridges may be significant as rare examples of a type, either as design experiments or widely accepted types that are no longer common. Other bridges, by their ubiquity, are significant as representative examples of a commonly used type and method of construction. Engineers also added aesthetic details, such as decorative balustrades, to some bridges which increase their significance beyond the pure mathematical application of the science.

National Register Criterion D: Under Criterion D, a bridge or its remains may be eligible for the National Register if it can yield important information about bridge technology or construction. The information should be embodied in the bridge or its remains; the mere existence, or former existence of a bridge at a particular location does not constitute sufficient important information. Furthermore, the information should not be available through other sources, such as historical documents or extant bridges. Prior inventories of Montana highway bridges have identified no properties that meet this criterion.

B. Property Types

I. Name of Property Type: Reinforced Concrete Highway Bridges

II. Description:

This property type includes those bridges constructed of concrete. Three types of concrete bridges were identified in Montana: (1) arch; (2) slab, and (3) T-beam. Concrete bridge design appropriated some forms, such as the arch, which was utilized for bridges made of metal, stone, and other materials. Likewise, concrete T-beam bridges were an adaptation of the I-beam stringer.

Arches are an ancient form of bridge. They come in a number of different profiles, ranging from a point-topped lancet to a broad ellipse to an essentially flat line. An arch's curve is determined by the number and relationship of "centers" used in its design and the length of the radii extending from these centers. Regardless of their profile or material, all arches have common components. The arch springs from a pair of imposts, which carry the base of the arch. The inner curve of the arch is called the intrados; the outer edge, usually not visually delineated on concrete bridges, is the extrados. If the extrados is highlighted by a molding or other ornament, the line is known as the archivolt. The triangular area buttressing the arch between the crown and the impost is the haunch. If the haunch is left unfilled in a concrete arch bridge, it is known as an open spandrel design; if filled, a closed

spandrel. Most frequently, the bridge deck rests on top of the arch. Special patented designs popular in the early 20th century, however, such as the Marsh rainbow arch, use a through-arch configuration.

Simple reinforced concrete slab bridges were an alternative to steel or timber stringer structures. A slab span is cast in forms as a single unit (poured or cast in place) with steel reinforcing bars. Because of the lack of structural support, considerable reinforcing steel was necessary to construct a concrete slab bridge. Because of the amount of reinforcing steel needed and the design, slab bridges were only economical for relatively short spans. The first known concrete slab bridges were constructed as irrigation ditch crossings in Carbon County in 1911. In Montana, concrete slab spans ranged in length from ten to twenty feet. The design, moreover was relatively easy to build and inexpensive to widen when traffic demands required wider structures. Early twentieth century concrete slabs were created at the construction site of the bridge, with the framework built by local carpenters or carpenters employed by a contractor. Concrete slab bridges are plain in appearance with variances in the design only in the types of guardwalls and railings.

T-beam bridges derive its name from the "T"-shaped configuration of the support beams. The head of the "T" is incorporated into the deck slab of the structure, which also functions as the bridge's floor. The T-beam design is, essentially, a modification of the standard steel I-beam design with concrete beams replacing steel beams. Contractors cast "T" beam bridges as single sections at the construction sites. Occasionally they fabricated the distinctive guardrails of the bridges as separate units. Montana State Prison inmates constructed the first known concrete T-beam bridge in Montana in 1911 (24PW608), while Carbon County built the first T-beam bridge with the beams recessed under the deck in 1913 (24CB1309). Though not as easily constructed as timber bridges, T-beam bridges were more suitable to areas of heavy traffic, relatively wide and shallow stream crossings where aggregate material was readily available, or where environmental conditions required an alternative to steel or timber structures. The bridges, however, required skilled labor (carpenters and concrete mixers) for their construction.

Workmanship and detailing on concrete bridges vary widely. Because concrete is an extremely malleable material, it can be cast in many forms. Virtually the only obvious design element in the vast majority of concrete bridges is the railing (or guardwall). There are three standard designs used for concrete bridges in Montana and are dependent on the time they were constructed: guardwalls with recessed panels or rectangular or diamond pattern openings (1911-1928), concrete post-and-beam guardrails (1929-1941), and steel post and baluster units (1945-1958).[46] There are variations to the basic concrete rail design and were dependent on location. In Montana's case, it was at urban entryways, approaches to national parks, and in residential neighborhoods. The variations include Classical Revival, Renaissance Revival and Federal style guardwalls.

III. Significance

Within the general guidelines for significance of Montana concrete bridges established in the introduction to the property types section, the following concrete bridge specific information is added:

Criterion A: The earliest documentation in the county records of concrete bridge construction in Montana is found in Carbon County in 1911. In 1911, the Carbon County commissioners hired Red Lodge cement contractor Gust Nash to construct seven concrete slab bridges over irrigation ditches throughout the county; the first bridge Nash built was a simple concrete slab bridge that crossed First Chance Ditch near Joliet.[47] The Montana State Prison

[46] Because the federal government concentrated its efforts on World War II, there were no funds available for road bridge construction to the states from 1942 until mid-1945 unless the US Departments of Army and Navy determined the facility was critical to the country's war effort. Jon Axline, *Conveniences Sorely Needed: Montana's Historic Highway Bridges, 1860-1956*, (Helena: Montana Historical Society, 2005), 112-113.

[47] Carbon County Bridge Record, Clerk and Recorders Office, Carbon County Courthouse, Red Lodge, Montana, 18-24.

in Deer Lodge also built several concrete bridges in Powell, Deer Lodge, and Silver Bow counties between 1911 and 1914. Bridges from this 1909 to 1915 period may have significance from experimentation with a new building material and for the expansion of local transportation networks.

Formed by the state legislature in 1913, the Montana State Highway Commission standardized concrete slab and T-Beam designs by 1916. Between 1925 and 1941, the commission and the Montana Highway Department built 123 reinforced concrete arch, slab, and T-beam bridges throughout Montana, fully 11 percent of the 1,119 bridges built during that period.[48] Although the bridges required skilled labor for the construction of the forms, the ready availability of the material, the department's willingness to experiment with new designs, and its suitability to the New Deal programs of the 1930s made concrete bridges an important part of its long-term program to improve Montana's infrastructure. These bridges have important associations with federally-sponsored, labor-intensive work programs, but are uniform in design and appearance.

Criterion C: Concrete bridge construction in Montana before the creation of the highway commission was restricted to Carbon County in south central Montana and in southwestern Montana. Of the ten contractors who built concrete bridges in the county, eight were residents of the county and two listed their occupation in the 1910 census as cement contractors (one was a pool hall manager). Two, the Beley Construction Company and Security Bridge Company, were better known for building steel truss bridges rather than concrete structures. Because the county bid out bridges for construction in groups, they are well documented in the county records; evidence also suggests that County Surveyor C. A. Gibson developed the standard design used for all slab and T-beam bridges in the county. The design for the monumental Fromberg Bridge (24CB1223; demolished 2007) was purchased by the county and adapted by the county surveyor to the construction site. In southwestern Montana, the state prison dominated concrete bridge construction. It is not known where the designs were obtained, but four concrete bridges identified by the MDT were built by convict labor. After 1916 when the highway commission standardized its first concrete bridge designs, concrete bridge construction was dominated by the state, who advertized for bids for their construction and awarded the contracts to both in- and out-of-state contractors. Great Falls architect George Shanley provided the designs for two multi-span concrete arch bridges across the Missouri River in 1920. Two other bridges were adapted and built from Shanley's original designs.[49]

Six representative concrete bridges dating from 1913 to 1936 were selected for inclusion in this document. National Register *Bulletin 15* states that a "structure is eligible as a specimen of its type or period of construction if it is an important example (within its context) of building practices of a particular time in history." In selecting the representative examples of concrete bridges, evaluation considered additional characteristics, such as being the oldest example, the longest span, the first of a particular design, or exhibiting decorative details not found in similar bridges. The oldest surviving bridges show the earliest extant use of the technology; the longest spans reflect maximum limits of technology, and the first examples of new designs demonstrate changes in technology and aesthetics. Decorative details are also important expressions of aesthetic details and design concepts.

There are also a few instances where county commissioners and state highway department engineers believed that some river crossings required bridges to be more aesthetically appealing. Most called for arch or false-arch structures or, in one example, brick-veneered concrete guardwalls. These structures were located at city gateways (the Tenth Street Bridge in Great Falls, 24CA308), in residential areas, and on scenic approach roads to national parks (the Carter Bridge in Park County,24PA841). Neither bridge followed standardized highway department concrete bridge designs and were designed under contract.

[48] From 1916 to 1924, the counties funded new bridge construction in Montana, while the state provided the plans, oversaw the bidding process, and supervised the construction of the structures. Unfortunately, the highway commission meeting minutes during that period were not specific as to the type of bridge that it let to contract. Instead, it generalized them in the numbers built, locations, etc. That reporting system became more specific in the meeting minutes in 1925, where specific type and number of bridges are described in the minute books. Axline, *Conveniences Sorely Needed*, 86.

[49] Carbon County Bridge Record; US Census Records, 1900-1930; Axline, Conveniences Sorely Needed, 67, 70.

IV. Registration Requirements

The period of significance for this property type is from 1911 (the construction date of Montana's oldest known surviving concrete bridge) to 1956 (the beginning of the Interstate highway era and the dominance of prestressed concrete structures). A concrete bridge may be eligible for the National Register if it meets one or more of the following criteria.

Criterion A: A concrete bridge in Montana may be eligible for the listing in the National Register if it was or is:

1. Built as part of Important Early Transportation Routes.
There are no concrete bridges associated with the initial development of the state's road system in the nineteenth century. Concrete bridge construction did not begin in Montana until 1909 in Carbon County. Construction of bridges in the county facilitated the transportation of agricultural goods, livestock, and coal to railroad stations in Red Lodge, Belfry, Bridger, and Fromberg. Concrete bridges built by prison labor were intended to improve transportation in the Deer Lodge vicinity and to facilitate the transportation of supplies to the prison from the railroad yards across the Clark Fork River. The bridges undoubtedly stimulated the growth of the surrounding rural areas on farm-to-market roads.

2. Any Bridge Associated with the Montana Highway Department's Initial Road-Building Program, 1916-1928
In 1915, the Montana State Highway Commission formed a bridge department, hired a bridge designer, and encouraged the state's counties to follow a prescribed process for advertising, bidding, and building steel truss, steel girder, and concrete bridges in the state. The process was designed to provide efficient, cost-effective bridges to the counties by standardizing the procedure and ensuring the counties got what they paid for. It was not until 1916, though, that the commission's bridge engineers standardized designs for concrete slab and T-beam structures. Designs for a monumental concrete arch bridge were developed by Great Falls architect George Shanley while under contract to Cascade County and the highway commission. During the 1920s, the commission and the Montana Highway Department refined the design for slab (Bad Route Creek Bridge, 24DW423) and T-beam bridges to better provide for increasing traffic demands on the state's highways. Bridges built under this initial phase immediately following the creation of the state bridge department would be eligible under Criterion A because they are part of a broader program to improve and modernize the state's transportation system.

3. Any Bridge Documented as being Constructed under a Federal Work Relief Program of the Depression Era, 1929 -1941
During the Great Depression (1930-1941), bridges were built under the Hoover Administration's emergency relief programs or during Franklin D. Roosevelt's New Deal. The state process was combined with new federal regulations to maximize labor and provide concrete bridges using the most up-to-date bridge technology. The result was the greatest period of road and bridge construction yet seen in Montana (it was surpassed in the 1960s and 1970s by the Interstate Highway program). The highway department built the majority of concrete bridges from 1930 to 1933 under the Hoover Administration's relief programs, which was picked up and modified by FDR during his administration. Bridges built during this period would be eligible for the National Register under Criterion A for their association with the Great Depression and the pre-war years.

4. Concrete Bridges Documented as being Constructed on Post-World War II Montana Highways, 1945-1958
The years after World War II and leading to the beginning of the Interstate highway program were among the most active for the Montana Highway Department. Increased federal spending on Federal Aid, urban, and secondary highways increased dramatically as the federal and state government strove to provide a modern transportation infrastructure that would serve the needs of rapidly changing traffic demands. The renewed road and bridge-building program was statewide and included the construction of 311 bridges between 1945 and 1956. Many of the bridges built during this period were later incorporated into the Interstate system. Bridges built during

this period would be eligible for the National under Criterion A for their association with the post-WWII economic and building boom.

National Register Criterion C: A concrete bridge in Montana may be eligible for listing in the National Register under Criterion C if it was or is:

1. Built by Carbon County, the Milwaukee Road Railroad or the Montana State Prison From 1911 to 1916. Bridges built by Carbon County and the State Prison reflect independent efforts by two governmental entities to provide inexpensive, efficient, and unique crossing structures for their constituents. There is no similarity in design in the bridges built by Carbon County and the prison suggesting that the basic designs were acquired from separate private companies. The bridges built by them appear to be bulkier and more massive than those later designed by the state. The aggregate used on them is also coarser than those built under state supervision after 1916. They likely also contain different reinforcing steel systems than those designed by the state. The Conley Street Bridge (24PW608) and 25th Street North Bridge (24CA331), moreover, incorporate ornamental elements into their designs. The ornamentation also reflects the opportunities afforded by concrete as a construction medium. The Milwaukee Road Railroad was one of the more technologically advanced railroad companies in the United States before World War I. Unlike the Northern Pacific, Union Pacific, and Great Northern railroads, the Milwaukee Road had demonstrated a willingness to try new building materials in an effort to prove the line's superiority over their competitors in the Treasure State. The 25th Street North Bridge is the sole remaining example of a concrete arch bridge built by the railroad for non-railroad traffic in Montana. Concrete bridges in Montana that were not designed by the state before 1916 are representative of the early years of practical bridge design and a willingness to experiment with a new building material.

2. Bridges Built from Designs Standardized by the Montana Highway Department, 1916-1958. State highway engineers standardized concrete slab and T-beam designs in 1916 and contracted with Great Falls architect George Shanley for a multi-span arch design in 1919. The department built specific styles of reinforced concrete bridges during specific time periods, i.e. 1916-1921, 1922-1928, 1929-1941, and 1945-1956. Those bridges contain components explicit to those time periods that were not repeated in other periods. For instance, bridges built before 1929 exhibited concrete guardwalls pierced by different types of openings (rectangles, arches, diamonds, turned baluster posts) or had recessed panels similar to the openings. Bridges built by the department between 1929 and 1941 exhibited art deco elements that were manifested in the double-coursed railings (Sheep Creek Bridge, 24LC1157). Bridges after World War II had steel post and baluster railings. A few bridges were widened on main highways in the state, but most have not been modified and retain the design elements significant to the type and era. The existing historic-age concrete bridges also reflect the transition from concrete slab bridges (1916-1922) to concrete T-beam bridges (1923-1956).

3. The Oldest Bridge in a County or Built by Convict or Railroad Labor (prior to 1916). Bridges with documented dates of construction as the oldest in a county or in an area have local significance.

4. The Oldest Bridge of a Type in Montana. The first concrete arch, concrete slab or concrete T-beam bridge built or of a particular design have local and statewide significance.

5. The Longest Bridge of a Type in Montana. Few concrete bridges exhibit long spans, but there are a few that have multi-spans that would qualify them under this category and have significance.

6. Bridges where all of the structural components are original to the structure. Like most man-made structures, modifications are made to bridges as the demands placed on them change. Substructures can be altered to handle heavier loads, widened to accommodate heavier traffic demands, additional structural components added, and new guardrails replacing original railings or guardwalls.

V. Integrity

In addition to the requirement that a bridge must meet one of more of the National Register criteria to be considered eligible for listing in the National Register, it must also retain integrity. The integrity of each bridge is assessed through the following aspects:

Design: For a bridge in this property type to retain integrity of design, the concrete structural members much be substantially in their original condition, although alterations made during the period of significance (through 1958) may be considered part of the bridge's historic fabric. Since railings are such a key visible component of the design of a concrete bridge, the original railings must be substantially intact, unless the bridge has important engineering features (e.g. it is a rare example of a structural type or it approaches the engineering limits for its type) that impart significance.

Materials: A concrete bridge retains integrity of materials if the structural materials and railings are original to the construction, replacement materials were installed during the period of historic significance, or modern repairs or replacements are the same type as those used during period of significance.

Workmanship: In concrete bridges, workmanship is embodied in evidence of the builder's labor and skill in concrete construction demonstrated through precision, technique, and durability. Integrity of workmanship is lost if the original construction evidence is covered with later materials or aesthetic details such as removal of the railings.

Setting and Location: Since it is virtually impossible to move a concrete bridge and have it retain design integrity, bridges must be in their original location. The original setting of some urban and park approach road concrete bridges affected their design selection.

Feeling and Association: These two aspects have equal effect on overall integrity of concrete bridges. The integrity of design, materials workmanship, location, and setting also has a direct bearing on the integrity of feeling and association. Integrity of feeling and association of a bridge will be lost if modern materials cover the historic materials, or the railings have been removed.

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G. GEOGRAPHICAL DATA

This nomination applies to properties located within the present boundaries of the State of Montana.

H. SUMMARY OF IDENTIFICATION AND EVALUATION METHODS

This Multiple Properties Nomination is a product of four distinct research and field survey projects: the original statewide historic bridge inventory in 1979-1980, a statewide field inventory and context development for Montana's reinforced concrete arch, slab, and T-beam highway bridges conducted by the Montana Department of Transportation in 1999. Two published works, *Historic Bridges in Montana* (Quivik 1982) and *Conveniences Sorely Needed: Montana's Historic Highway Bridges, 1860-1956* (Axline 2005) have also been produced that deal with Montana's concrete bridges. The field surveys and historic context (2000) culminated in the preparation of this document and six individual National Register nominations that accompany it. Each of the phases is discussed below.

Three reinforced concrete bridges have previously been listed in the National Register in Montana. They are:

1. Tenth Street Bridge (24CA308; listed 1996)
2. Fromberg Bridge (24CB1223; listed 1993 and demolished in 2007)
3. Morel Rainbow Arch Bridge (24DL411; listed 2000)

1. Field surveys and context development (1979-1980 and 2000)

Montana conducted one of the first state-sponsored historic bridge inventories in the United States in 1979. In addition to recording steel truss, reinforced concrete, and steel girder bridges, the survey also included railroad bridges that were not under county or state jurisdiction. The field survey along with the background research provided the basis for additional historic bridge surveys conducted by the Montana Department of Transportation (MDT) in 1986 (treated timber bridges), 1999 (reinforced concrete bridges), and 2000 (truss bridges built between 1935 and 1946). Renewable Technologies, Inc. (RTI) of Butte, Montana conducted the 1979-1980 inventory, under contract to the MDT. Frederic Quivik and Gray Fitzsimons conducted the survey; Jet Lowe provided photographs of the bridges. The intensive field survey inventoried 477 historic highway and railroad bridges in the state, and also completed substantial primary and secondary research related to the history of Montana's bridges. That survey provided the basis for subsequent historic bridge surveys conducted in Montana. Primary research included construction files and plans at the MDT for on-system bridges. For off-system structures, RTI conducted research in city halls and county courthouses, specifically in the county commissioner and city council meeting minutes and road books. Secondary research included county histories, J.A.L. Waddell's *Bridge Engineering* (John Wiley & Sons 1916) and Milo Ketchum's *The Design of Highway Bridges* (McGraw-Hill 1912). In addition, to those sources, some bridges have dedication plates attached to them that provide the date of construction and the name of the contractor.

The MDT also initiated a bridge inspection program in 1979. The inspections included both on-system bridges administered by the MDT and off-system bridges under the jurisdiction of cities and counties. Because of this inspection program, the MDT was able to provide RTI with a list of bridges built before 1930 and their locations. The resulting field survey conducted by RTI included only those structures inspected by the MDT. In 1982, the MDT and the National Park Service published Quivik's *Historic Bridges in Montana*, a seminal work that was among the first publications in the United States to address historic bridges. The book provided the basis for additional Montana bridge surveys and for this document. It was not until 1985, however, that the MDT submitted a Determination of National Register Eligibility for historic bridges to the Montana State Historic Preservation Office (SHPO). The SHPO concurred in the determination that 77 bridges were eligible for the National Register and that 400 bridges were ineligible for the National Register. The criteria outlined in Section "F" above provided the basis for that first determination of eligibility for historic bridges in 1985.

RTI's historic bridge survey and the 1985 determinations of eligibility provided the basis for the MDT's management of historic bridges for the next twelve years. In 1989, the Montana SHPO, Federal Highway Administration (FHWA), Advisory Council on Historic Preservation (ACHP), and the MDT implemented a programmatic agreement (PA) concerning historic roads and bridges. The PA, the first of its kind in the United States, abrogated the MDT's requirement to further inventory historic roads and bridges within the state. Instead, it required the department to complete narrative and technical histories of road and bridge development in the state. Consequently, the MDT produced *Roads to Romance: The Origins and Development of the Road and Trail System in Montana* (Wyss 1992) and *Monuments Above the Water: Montana's Historic Highway Bridges* (Axline 1993). The agreement also specified that the MDT develop educational programs and an Adopt-A-Bridge Program. The PA remained in effect until supplanted by expanded agreement's in 1997 and 2007.

2. 1999 Field Review

In 1999, the MDT initiated a survey of historic reinforced concrete bridges that were not included in the original 1979-1980 bridge survey. This survey, which was conducted by MDT Historian Jon Axline, included 122 arch, slab, and T-beam bridges built by the MDT and the counties between 1900 and 1956. However, instead of treating them thematically as was done with the steel truss bridges in 1985, the MDT made determinations of eligibility on a case-by-case basis per the terms of the expanded 1997 PA.

3. 2007 Programmatic Agreement and publication of *Conveniences Sorely Needed: Montana's Historic Highway Bridges, 1860-1956*.

In 2007, the Montana SHPO, FHWA, ACHP, and the MDT implemented a new PA that better addressed the management of the state's remaining historic steel truss bridges than had the 1989 and 1997 documents. The document contains provisions for the development of an historic bridge database, the implementation of an historic bridge rehabilitation program, and the development of Multiple Properties Documents for steel truss, reinforced concrete, timber, and steel stringer and girder structures. The Adopt-A-Bridge Program was carried forward in the 2007 PA. Prior to 2007, however, the MDT amended the 1997 PA to better handle historic bridges that could not feasibly be relocated under the Adopt-A-Bridge Program. These included reinforced concrete and substantial steel stringer and steel girder structures. The amendment stipulated that the MDT and Montana Historical Society would cooperate in the production and publication of a book on Montana's historic highway bridges. The book built on the groundwork laid by RTI and Frederic Quivik and included additional research in both primary and secondary sources by the author, Jon Axline. The book, *Conveniences Sorely Needed: Montana's Historic Highway Bridges, 1860-1956*, provides an historic context for Montana bridges built between 1860 and 1956. The Montana Historical Society Press published the book in 2005.

4. National Register of Historic Places nominations (2008)

Stipulation 4(C) of the 2007 Programmatic Agreement states that the MDT will "develop National Register Multiple Property Documents (MPD's) for steel truss, reinforced concrete, steel stringer, girder, and timber bridges in Montana." To complete that stipulation, the MDT evaluated 122 on- and off-system reinforced concrete arch, slab, and T-beam bridges in Montana for possible nomination under an MPD in 2009. Consequently, six bridges suitable for individual National Register nominations as part of an MPD submittal were developed by the MDT in 2009 and submitted as part of this MPD. All six bridges are eligible for listing on the National Register of Historic Places under Criteria A and C. None have been programmed by the MDT or nominated by the counties for replacement. Two of the bridges are owned by the MDT and four are off-system and county-owned. Each of these bridges have been photographed. Additional research in primary and secondary sources about each structure was completed and included in the National Register nomination forms.

Using the 1979-1980 research materials, supplemented by additional research done between 1990 and 2008, MDT Historian Jon Axline prepared this Multiple Properties form and the individual nomination forms during the Fall of 2009. All products were submitted to the Montana SHPO in September 2010.

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